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## **Operating Instructions**

### **DK10**

*Flap Flowmeter*

# Installation and Maintenance Instructions

## Installation Instructions:

The flow indicators are in-line devices. Mounting can be in any position, and no straight length of pipe is required before or after the unit. The unit is sandwiched between two flanges. Under the Pressure Equipment Directive (PED) these products are Pressure Accessories, and are not approved for use as safety Accessories, as defined by the PED. If used for safety purposes, it is the responsibility of the user/installer to assess the suitability of the product in the pressure equipment or system in which it is used.

### It is the responsibility of the user/installer of this equipment to ensure:

1. The product is installed and used by suitably trained personnel in accordance with all relevant Local and National regulations and codes.
2. Safe working practices for the media & processes concerned are followed during installation & maintenance.
3. The materials of construction are suitable for the application.
4. The product is protected from fire.
5. The product is protected from impact/vibration.
6. The instrument is only cleaned by washing with detergent, do not use abrasive cleaners or solvents.
7. For outdoor use in exposed positions the instrument must be additionally protected/shielded from heavy rainfall.
8. Regular inspection for corrosion/erosion and wear are carried out.

## Essential Safety Requirements:

1. The instrument must be installed in accordance with the instructions provided.
2. Prior to installation ensure pipelines are flushed/drained to ensure they are free from any solid particles or pressure.
3. Care must be taken to avoid introducing torsional stress on the instrument when installing into the pipeline. Tighten sufficiently to avoid leaks & check at regular intervals during maintenance.
4. Ensure pipelines are fully primed before commencing normal use.
5. Valves must be opened or closed gradually to avoid shock/vibration.
6. Do not exceed maximum working pressure as stated on the label.
7. Only use with the fluid/gas stated on the label.
8. Do not exceed minimum/maximum working temperature as stated.
9. Do Not Use instrument if any part of the cable appears to be damaged.
10. Isolate instrument before removing cover.

## General Maintenance:

1. Remove instrument from pipeline.
2. Remove from flanges (keep enclosure box and spring housing intact)
3. Check for and remove any swarf/foreign body, clean if necessary.
4. Remove faceplate and window
5. Check pointer is still firmly secured
6. Push open the valve plate, (depending on flow rate tension may be high), the valve plate will spring back to 0 when released. Repeat a few times at different points along the scale.
7. Listen/watch the switch to make sure it is activated at desired min/max flow as the valve plate is pushed open. (Adjust cam if necessary)
8. DO NOT remove or adjust springs as this will affect the calibration of the instrument.
9. Re-assemble instrument,

## Switch Setting:

The cam which operates the microswitch is situated on the spindle behind the pointer and can be adjusted to give an alarm anywhere between zero and max, flow. To alter the setting, lift the cam and rotate the cam in the direction required until switch point is located, then gently lower cam in that position.

## Enclosure box rotation instructions-change of flow direction

**Tools required:** Screw driver, Allen wrench set , 5/16 nut driver

- 1.) Remove 4 screws from nameplate. -5/16 Nut Driver
- 2.) Remove Name Plate and Window
- 3.) Remove Calibrated Scale.
- 4.) Remove Electrical Switch -Screw Driver (if monitor does not have switch(es) go to #5.)
- 5.) Remove all 4 Allen Screws (5/32 or 4mm Allen Wrench) at base of enclosure and rotate enclosure box to the desired position
- 6.) Place 4 Allen Screws back into required tapped and tighten control box to meter body.
- 7.) Loosen Indicator Pointer

**NOTE:** if monitor does not have switch(es) skip to #11)

- 8.) "Slightly" Loosen Cam Set Screw just enough to move cam on dial. (**DO NOT LOOSEN DIAL SET SCREW LOCATED BELOW THE CAM**). This will make easier to tighten once switch contact point is set.) -1/8 (3.175mm)Allen Wrench
- 9.) Place Switch back into enclosure box and tighten until snug - **DO NOT OVER TIGHTEN**

**NOTE:** Switch should be wired prior to re-installation

- 10.) Rotate Cam to desired Set Point and tighten Allen Screw/Replace Compression Spring until snug. Cam will press against switch roller arm to actuate switch.
- 11.) Place Calibrate Scale and tighten back in position. - **DO NOT OVER TIGHTEN**
- 12.) Move Pointer to zero position on calibrated scale and tighten
- 13.) Place Window then nameplate back on enclosure box and tighten Allen Screws.

**Estimated time to rotate control box: 10 to 15 minutes.**

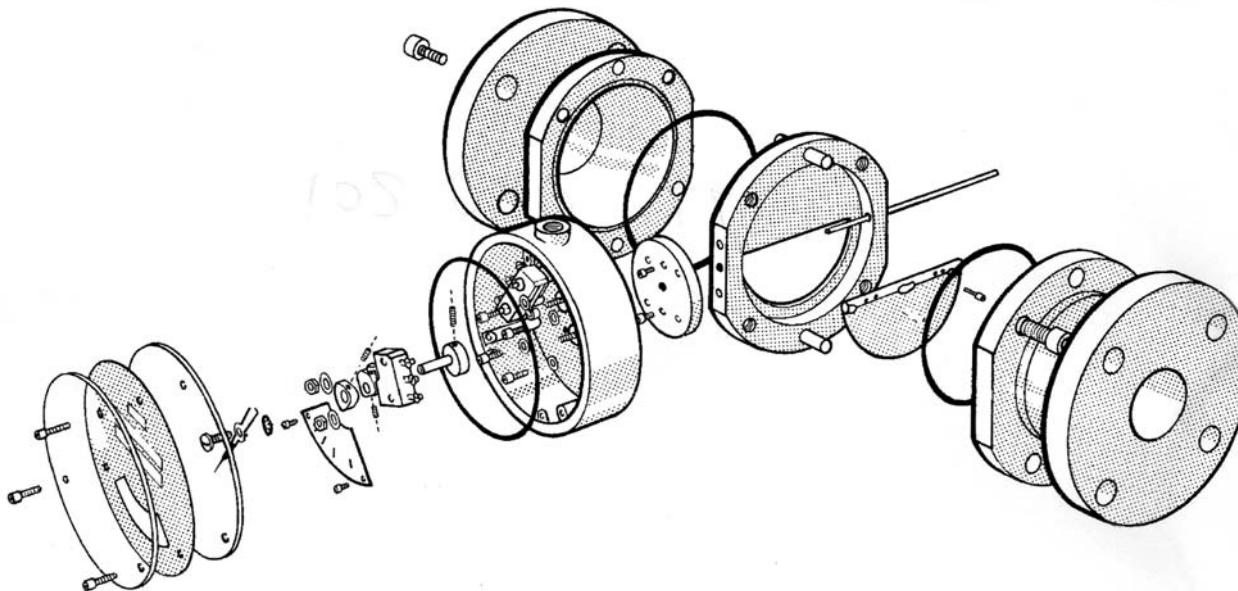
## Troubleshooting:

1. In the event of a pointer appearing to stick in one position, remove centre housing and clean away pipe scale to ensure that valve plate is free to return to its seating position. (A spacer can be provided so that the flow can pass through whilst maintenance is being carried out)
2. If the pointer 'trembles' allow flow to continue. 'Trembling' is usually air entrapment, and this will be eliminated when the system becomes full.
3. At regular intervals the control valve to the circuit should be closed for one second and then opened to ensure that no large foreign body is holding the vane in one position. The indicator should drop to zero when closing the valve, and then when the valve is opened again return to the running flow point. When carrying out the procedure in 3. the indicator will immediately return to a position a little less than the running flow position and slowly return to the correct reading. This is due to the hysteresis of the 'O' rings and spring.

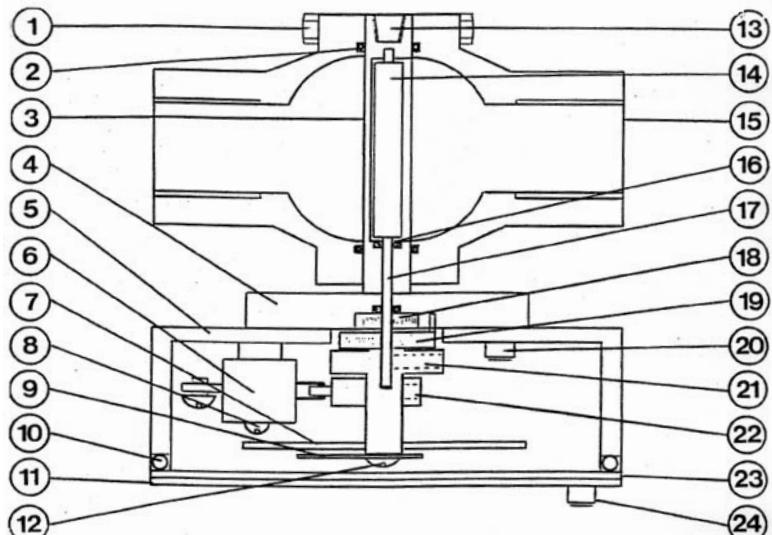
# Small Series Spares Data

When ordering spares, please give reference number followed by quantity required

All orders should be accompanied by a model number and a serial number of the Flow switch!



| Item | Description  |
|------|--|
| 1.   | Stud & Nuts  |
| 2.   | O-Ring   |
| 3.   | S1, S2, S3, S4   |
| 4.   | Centre Housing   |
| 5.   | AL, B, CI, CIK, S, SS, PVC   |
| 6.   | Mounting Disc  |
| 7.   | Enclosure Box  |
| 8.   | Switch   |
| 9.   | 3EE, 3EEG, 4EE, 6EE, 3EE(ATEX3), 3EE(ATEX2), 6EE(ATEX2), AIR, POT, OUT, DIG, TOT |
| 10.  | Dial Plate   |
| 11.  | Screw  |
| 12.  | Pointer  |
| 13.  | (a) Rear O-Ring  |
| 14.  | (b) Front O-Ring   |
| 15.  | Face Plate   |
| 16.  | Screw  |
| 17.  | Plug   |
| 18.  | Valve Plate  |
| 19.  | Bowl   |
| 20.  | AL, B, CI, CIK, S, SS, PVC   |
| 21.  | O-Ring   |
| 22.  | S1, S2, S3, S4   |
| 23.  | Spindle  |
| 24.  | Bearing  |
| 25.  | Spring   |
| 26.  | Screw  |
| 27.  | Indicator Dial   |
| 28.  | Cam  |
| 29.  | Window   |
| 30.  | Screw  |



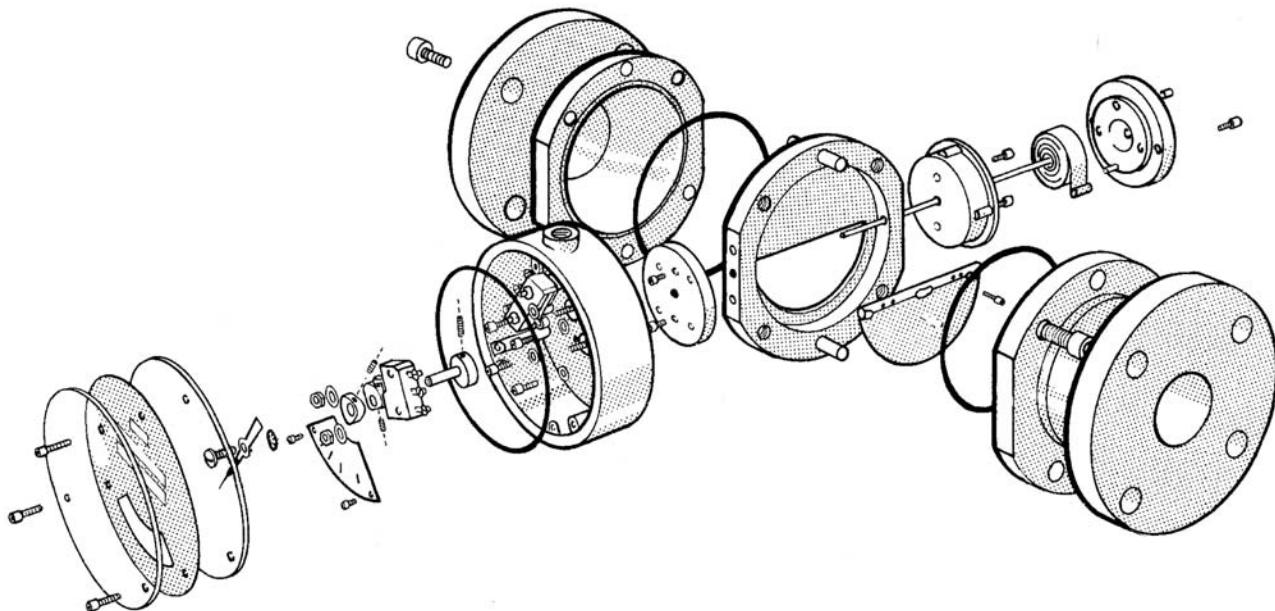
## Spares Kit

| Item | Qty   |
|------|-------|
| 2    | 2-off |
| 6    | 1-off |
| 8    | 2-off |
| 10   | 1-off |
| 16   | 4-off |
| 23   | 1-off |
| 24   | 3-off |

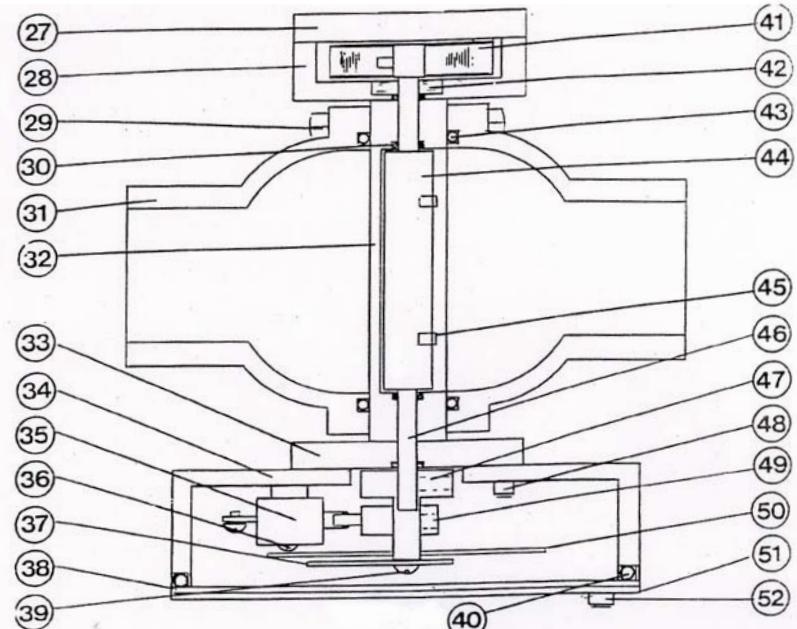
# Medium Series Spares Data

When ordering spares, please give reference number followed by quantity required

All orders should be accompanied by a model number and a serial number of the Flow switch!



| Item | Description  |
|------|--|
| 27.  | Spring Cover   |
| 28.  | Spring Housing   |
| 29.  | Stud & Nuts  |
| 30.  | O-Ring   |
| 31.  | S1, S2, S3, S4   |
| 31.  | Bowl Screwed/Flanged   |
| 31.  | AL, B, CI, CIK, S, SS, PVC   |
| 32.  | Centre Housing   |
| 32.  | AL, B, CI, CIK, S, SS, PVC   |
| 33.  | Mounting Disc  |
| 34.  | Enclosure Box  |
| 35.  | Switch   |
| 35.  | 3EE, 3EEG, 4EE, 6EE, 3EE(ATEX3), 3EE(ATEX2), 6EE(ATEX2), AIR, POT, OUT, DIG, TOT |
| 36.  | Screw  |
| 37.  | Pointer  |
| 38.  | Window   |
| 39.  | Screw  |
| 40.  | (a) Rear O-Ring  |
| 40.  | (b) Front O-Ring   |
| 41.  | Spring   |
| 42.  | Bearing  |
| 43.  | O-Ring   |
| 43.  | S1, S2, S3, S4   |
| 44.  | Valve Plate  |
| 45.  | Grub Screw   |
| 46.  | Spindle  |
| 47.  | Indicator Dial   |
| 48.  | Screw  |
| 49.  | Cam  |
| 50.  | Dial Plate   |
| 51.  | Face Plate   |
| 52.  | Screw  |



## Spares Kit

| Item | Qty   |
|------|-------|
| 30   | 4-off |
| 35   | 1-off |
| 36   | 2-off |
| 38   | 1-off |
| 40   | 1-off |
| 43   | 2-off |
| 52   | 3-off |



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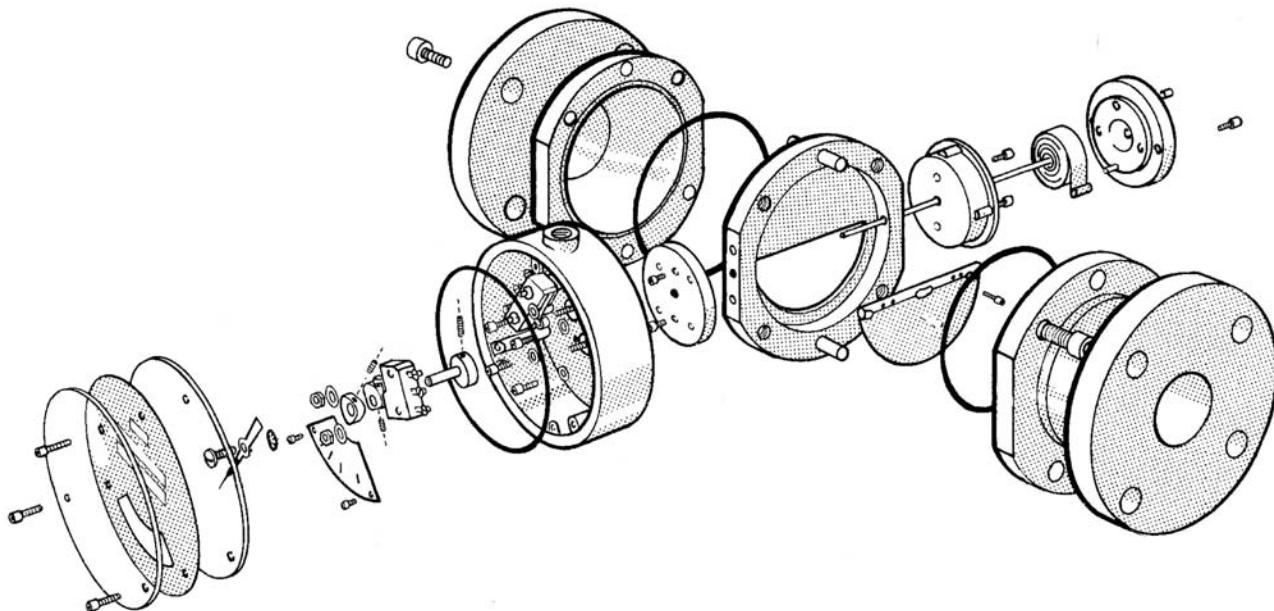


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# Large Series Spares Data

When ordering spares, please give reference number followed by quantity required.

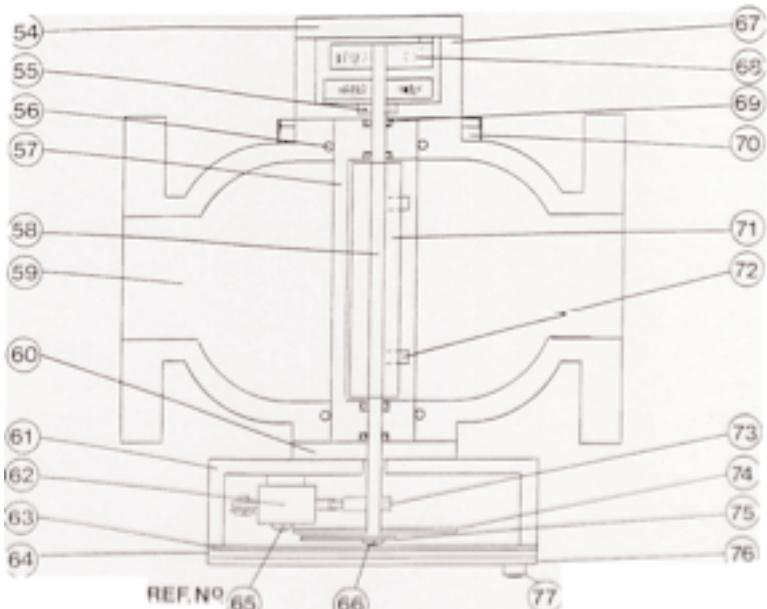
All orders should be accompanied by a model number and a serial number of the Flow switch!



| Item | Description   |
|------|---|
| 54.  | Spring Cover  |
| 55.  | Bearing   |
| 56.  | O-Ring  |
|      | • S1, S2, S3, S4  |
| 57.  | Centre Housing  |
|      | • AL, B, CI, CIK, S, SS, PVC  |
| 58.  | Spindle   |
| 59.  | Flange  |
| 60.  | Mounting Disc   |
| 61.  | Enclosure Box   |
| 62.  | Switch  |
|      | 3EE, 3EEG, 4EE, 6EE, 3EE(ATEX3), 3EE(ATEX2),<br>6EE(ATEX2), AIR, POT, OUT, DIG, TOT |
| 63.  | Gasket  |
| 64.  | Window  |
| 65.  | Screw   |
| 66.  | Screw   |
| 67.  | Spring Housing  |
| 68.  | Spring  |
| 69.  | O-Ring  |
|      | • S1, S2, S3, S4  |
| 70.  | Stud and Nuts   |
| 71.  | Valve Plate   |
| 72.  | Screw   |
| 73.  | Cam   |
| 74.  | Dial Plate  |
| 75.  | Pointer   |
| 76.  | Face Plate  |
| 77.  | Screw   |

## Spares Kit

| Item | Qty   |
|------|-------|
| 62   | 1-off |
| 64   | 1-off |
| 56   | 4-off |
| 77   | 4-off |
| 63   | 1-off |
| 65   | 2-off |
| 69   | 2-off |

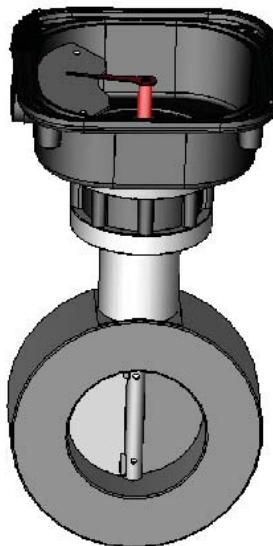
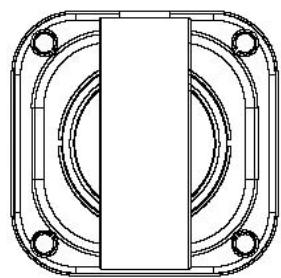
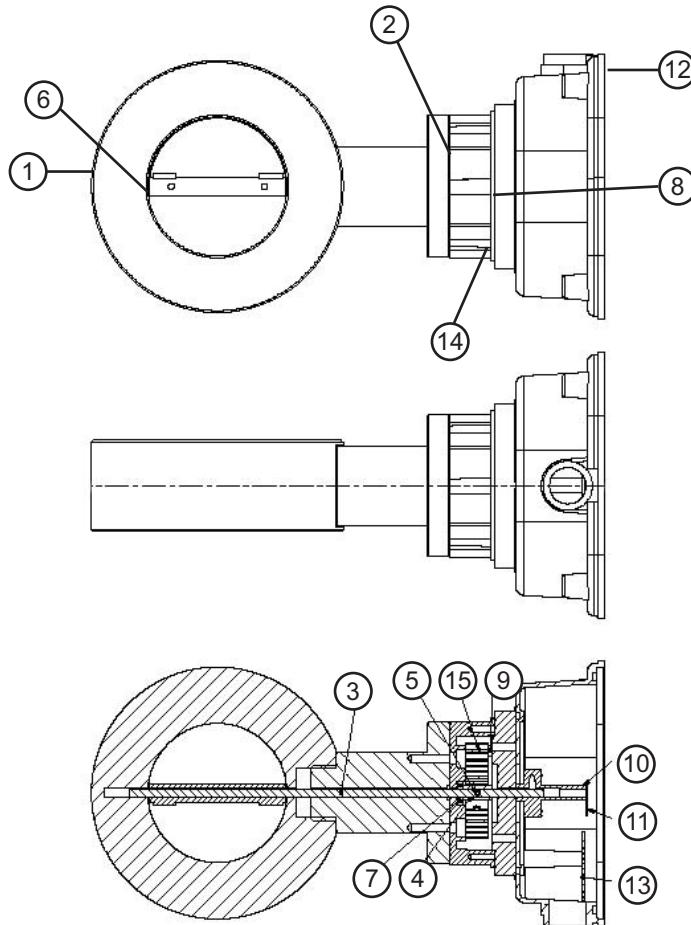


## Wafer Series Spares Data

When ordering spares, please give reference number followed by quantity required.

All orders should be accompanied by a model number and a serial number of the Flow switch!

| Item No. | Part No.                | Qty. |
|----------|-------------------------|------|
| 1.       | Wafer Body              | 1    |
| 2.       | Wafer Al Neck           | 1    |
| 3.       | Indicator Rod           | 1    |
| 4.       | Indicator Rod - Boss    | 1    |
| 5.       | Indicator Rod - Peg     | 1    |
| 6.       | Valve Plate             | 1    |
| 7.       | Indicator Rod - Bearing | 1    |
| 8.       | Collar                  | 1    |
| 9.       | Collar - Peg            | 1    |
| 10.      | Pointer Boss            | 1    |
| 11.      | Pointer                 | 1    |
| 12.      | Indicator Housing       | 1    |
| 13.      | Indicator Plate         | 1    |
| 14.      | Medium Spring Housing   | 1    |
| 15.      | Spirol Spring           | 1    |



Wafer General Assembly



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## DK10

### Flap Flow Meters

- **robust design, can be installed in any position, insensitive to dirty/contaminated liquids**
- **suitable for 1/4" to 2" pipes with threaded fittings, and – as a wafer version – for 3" to 8" pipes**
- **many different material combinations for practically all types of process liquids**
- **max. pressure = 200 bar, max. temperature = 330 °C**
- **for viscosities up to 600 cSt**
- **mechanical flow indication**
- **electrical outputs: 4 - 20 mA, 1 or 2 microswitches**



#### Description:

The DK10 series flap flow meter comprises a spring-loaded flap mounted in a hemispherical chamber. The flap is deflected by the flow in the line. The deflection is directly proportional to the flow rate. The movement of the flap is transmitted via a shaft – that is sealed off from the process – to a mechanical pointer and the flow is displayed on a scale. One or two microswitches for flow monitoring or an analog output module can be installed in the display enclosure (optional). Each flow meter is calibrated for the liquid being monitored based on customer specifications. The devices are available with G or NPT threads for 1/4" to 2" pipes and as a wafer for mounting between two DIN or ANSI flanges on DN80 (3") to DN200 (8") pipe sizes.

#### Typical Applications:

Due to their robust design, their resistance to dirty or contaminated liquids and the variety of material combinations available, the DK10 flap flow meters are suitable for use as control and monitoring devices for practically all process liquids.



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## Models:

**DK10...** Flap flow meter with a directly coupled mechanical pointer

## Materials:

Flaps and shafts are made of stainless steel for all device materials. Shafts made of titanium or Hastelloy, as well as plastic flaps, are available for aggressive/caustic liquids and for plastic models.

A Aluminum (low-cost for oils), Tmax = 200 °C  
 B Bronze (e.g. for sea water), Tmax = 250 °C  
 C Cast iron (for general-purpose applications), Tmax = 200 °C  
 CN Cast iron, nickel-plated (corrosion proof), Tmax = 200 °C  
 S Cast steel, Tmax = 250 °C  
 V Stainless steel, Tmax = 330 °C  
 PT PTFE, Pmax = 7 bar, Tmax = 150 °C  
 PV PVC, Pmax = 7 bar, Tmax = 60 °

## Gaskets:

The choice of sealing material depends on the liquid being monitored and the expected temperatures.

B Buna (Perbunan, -40 to +110 °C)  
 E EPDM (-40 to +150 °C)  
 V Viton (-20 to +200 °C)  
 PT PTFE (-100 to +250 °C)  
 PF Perlast (Perfluor elastomer, -15 to +330 °C)

## Measurement ranges:

The quoted measurement ranges serve as a rough guide only. The exact measurement ranges for a given device are calculated during manufacture based on the exact pipe diameter and calibrated in the devices.

| Process connection (G or NPT) | Meas-<br>urement<br>range<br>No. | Measurement ranges |                              |                |                |
|-------------------------------|----------------------------------|--------------------|------------------------------|----------------|----------------|
|                               |                                  | L/min<br>(...LM)   | M <sup>3</sup> /h<br>(...MH) | GPM<br>(...GM) | GPH<br>(...GH) |
| <b>Housing size S</b>         |                                  |                    |                              |                |                |
| 1/4"                          | 1                                | 4 - 15             | 0.24 - 0.9                   | 1.0...4.0      | 60 - 240       |
| 1/2"                          | 2                                | 4 - 30             | 0.24 - 1.8                   | 1.0...8.0      | 60 - 480       |
| 3/4"                          | 3                                | 4 - 50             | 0.24 - 3.0                   | 1.0...13.2     | 60 - 800       |
| 1"                            | 4                                | 4 - 70             | 0.24 - 4.2                   | 1.0...18.5     | 60 - 1,100     |
| <b>Housing size M</b>         |                                  |                    |                              |                |                |
| 3/4"                          | 5                                | 40 - 100           | 2.4 - 6.0                    | 10 - 26.4      | 600-1,600      |
| 1"                            | 6                                | 40 - 150           | 2.4 - 9.0                    | 10 - 40.0      | 600-2,400      |
| 1 1/4"                        | 7                                | 40 - 220           | 2.4 - 13.2                   | 10 - 58.0      | 600-3,500      |
| 1 1/2"                        | 8                                | 40 - 350           | 2.4 - 21.0                   | 10 - 92.5      | 600-5,500      |
| 2"                            | 9                                | 40 - 500           | 2.4 - 30.0                   | 10 - 132       | 600-8,000      |
| <b>Housing size L (wafer)</b> |                                  |                    |                              |                |                |
| DN80 / 3"                     | 10                               | 120 - 1,500        | 7.2 - 90                     | 32 - 400       | 1,900-23,700   |
| DN100 / 4"                    | 11                               | 120 - 2,000        | 7.2 - 120                    | 32 - 530       | 1,900-31,700   |
| DN150 / 6"                    | 12                               | 120 - 3,500        | 7.2 - 210                    | 32 - 925       | 1,900-55,500   |
| DN200 / 8"                    | 13                               | 120 - 5,000        | 7.2 - 300                    | 32 - 1320      | 1,900-79,200   |

## Ordering Code:

| Order number:          | DK10. | B. | B. | G2LM. | MP. | 1. | M. | R |
|------------------------|-------|----|----|-------|-----|----|----|---|
| <b>Flap flow meter</b> |       |    |    |       |     |    |    |   |

### Enclosure material:

A = Aluminum  
 B = Bronze  
 C = Cast iron  
 CN = Cast iron, nickel-plated  
 S = Steel casting  
 V = Stainless steel  
 PT = PTFE  
 PV = PVC  
 9 = custom material

### Sealing material:

B = Buna  
 E = EPDM  
 V = Viton  
 PT = PTFE  
 PF = Perlast  
 9 = custom gasket

### Measuring ranges and process connections

(please append to range code LM / MH / GM / GH for unit of measure):

G1...G9 = range 1-9, G 1/4" female G2  
 N1...N9 = range 1-9, 1/4" NPT female - 2" NPT female  
 D10...D13 = range 10-13, for flanges to DIN, DN 80-DN200  
 A10...A13 = range 10-13, for flanges to ANSI, 3"-8"  
 9 = custom range

### Pressure rating:

LP = max. 20 bar / 300 psi  
 MP = max. 50 bar / 750 psi  
 HP = max. 200 bar / 3000 psi  
 9 = custom design

### Viscosity of process liquid:

1 - 600 = please specify viscosity of liquid at operating temperature in cSt (mm<sup>2</sup>/s)

### Outputs:

M = none, mechanical flow indication only  
 S1 = 1 x microswitch, 3-pin changeover contact  
 S2 = 2 x microswitches, 3-pin changeover contact  
 SG1 = 1 x microswitch, gold-plated contacts, 3-pin changeover contact  
 SG2 = 2 x microswitches, gold-plated contacts, 3-pin changeover contact  
 A2 = analog output 4 - 20 mA, 2-wire, 8 - 28 VDC  
 A3 = analog output 4 - 20 mA, 3-wire, 8 - 28 VDC

### Direction of flow:

L = from left to right  
 R = from right to left  
 U = up  
 O = down

## Pressure Rating:

**LP** max. 20 bar / 300 psi  
**MP** max. 50 bar / 750 psi  
**HP** max. 200 bar / 3000 psi (for cast iron, cast steel or stainless steel enclosures only)

## Specifications (mechanical):

|                                 |   |
|---------------------------------|---|
| <b>Max. pressure:</b>           | 20 / 50 / 200 bar<br>300 / 750 / 3000 psi<br>plastic enclosure max. 7 bar / 100 psi |
| <b>Liquid-temperature:</b>      | -100 to +330 °C (depending on device materials and sealing material)                |
| <b>Measurement uncertainty:</b> | +/- 3% of end value   |
| <b>Max. flow:</b>               | min. 2 x end value  |
| <b>Installation position:</b>   | any   |

## Limit contacts:

One or two electromechanical limit switches - that can be adjusted over the entire measurement range - can be fitted to DK10 flow meters.

### Models

**S1/S2:** One or two microswitches as 3-pin changeover contact

### Switching capacity:

15 A, 250 V  
0.5 A, 125 VDV /  
0.25 A, 250 VDC

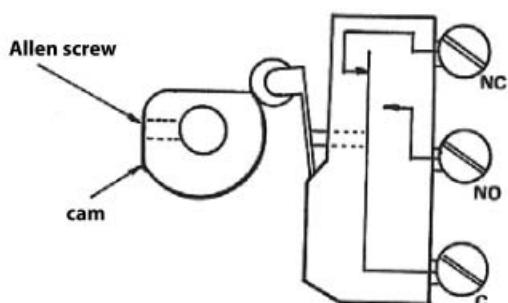
### Models

**SG1/SG2:** as for S1/S2, but with gold-plated contacts

### Factory set switch point:

available upon request

## Electrical Connection:



## Analog output:

The optional analog output on the DK10 meter is available as a 2- or 3-wire circuit. It provides a 4 - 20 mA signal that corresponds with the calibrated measurement range.

### Models:

**A2:** 2-wire circuit

**A3:** 3-wire circuit

**Output range:** 4...20 mA = 0 - end value ( $\pm 5\%$ )

**Linearity:**  $\pm 1\%$

**Repeatability:** < 0,2%

**Supply:** 8 - 28 VDC, 50 mA max.

**Overvoltage protection:** max. 30 V

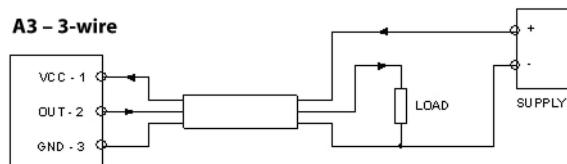
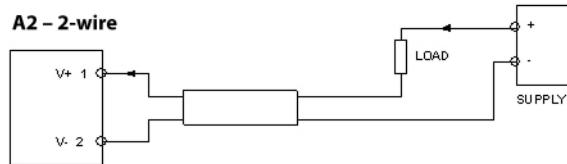
**Max. load impedance:**

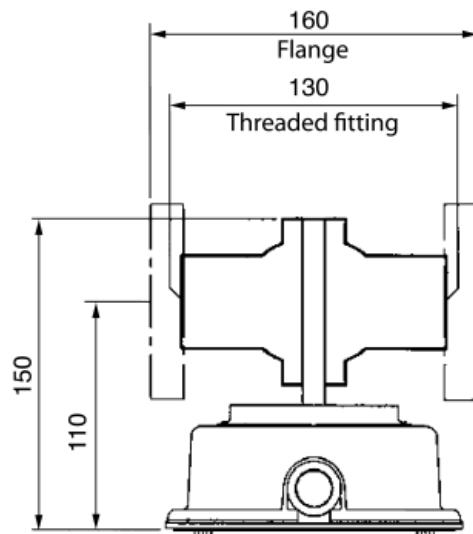
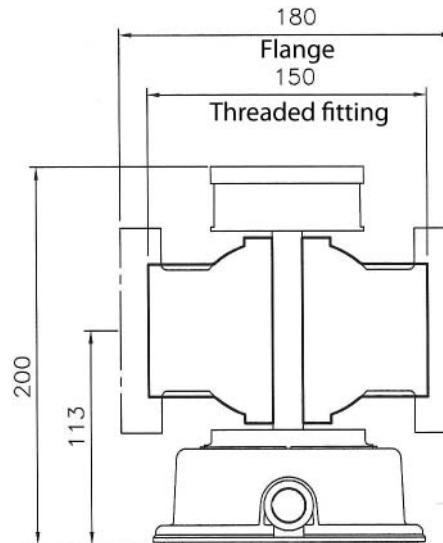
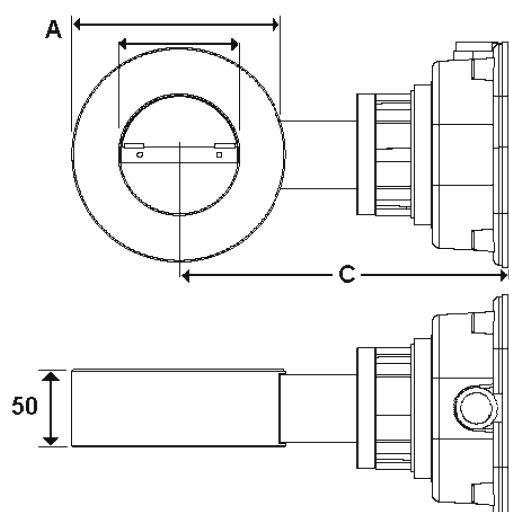
**A2:**  $R < (U-8V)/0.02mA$

**A3:**  $R < (U-3V)/0.02mA$

**Operating temperature:** -40 to +85 °C

## Electrical Connection:



**Dimensions:****Chamber S:****Chamber M:****Chamber L (wafer):**

| DN  | A (mm) | C (mm) | ANSI | A (mm) | C (mm) |
|-----|--------|--------|------|--------|--------|
| 80  | 138    | 216    | 3"   | 127    | 210    |
| 100 | 158    | 226    | 4"   | 157    | 217    |
| 150 | 218    | 264    | 6"   | 216    | 263    |
| 200 | 278    | 291    | 8"   | 270    | 287    |